



SUSTAINING BIODIVERSITY CONSERVATION IN AND AROUND NYUNGWE NATIONAL PARK (NNP)

 $\begin{tabular}{ll} Associate Cooperative Agreement N^o Aid-696-La-10-00001 under Leader \\ Cooperative Agreement N^o Eem-A-00-09-00007-00 \\ \end{tabular}$

BASELINE STUDY ON BAMBOO DEVELOPMENT POTENTIAL AROUND NYUNGWE NATIONAL PARK

September 2012



Association Rwandaise des Ecologistes





REPORT OF BASELINE STUDY ON BAMBOO DEVELOPMENT POTENTIAL AROUND NYUNGWE NATIONAL PARK

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TABLE OF CONTENT

TΑ	ABLE OF CONTENT	i
TA	ABLE OF FIGURES	ii
LIS	ST OF TABLES	iii
ΑB	BBREVIATIONS AND ACRONYMS	V
ΑB	BSTRACT	vi
AC	CKNOWLEDGEMENT	vii
I.	INTRODUCTION	1
-	1.1 ObjectivesError! Bookmark not	defined.
II.	APPROACH AND METHODOLOGY	2
2	2.1 Description of the study area	4
III.	DATA FINDINGSError! Bookmark not	defined.
3	3.1 EXPECTED RESULTS Error! Bookmark not	defined.
	3.1.1. Quantitative assessment of bamboo demand and users: Error! Bookm defined.	ıark not
	3.1.2 Quantitative and/or qualitative data of bamboo contribution to livelihood: Bookmark not defined.	s. Error!
3	3.2 PRESENTATION OF RESPONDENTS ACCORDING TO SECTORS	3
	3.2.1 Uses of bambooError! Bookmark not	defined.
	3.2.2 Proportion of bamboo used for local and commercial purposes	6
	3.2.3 Bamboo products for income generation	8
	3.2.4 Suggestions to increase bamboo availability in the region	8
	3.2.5 Severity of bamboo cutting in Nyungwe National Park	26
	3.2.6 Measures taken to manage and prevent cutting in the park	27
	3.2.7Effectiveness of measures taken	27
	3.2.8 Suggestions on alternatives to bamboo cutting inside the park	28
	3.2.9 Impact of cutting (threats) to plants and wildlife in the park	28
	3.2.10 Partners in bamboo planting outside the park	11
	3.2.11 Success of bamboo programs in surrounding zones of NNP	11

3.2.12 where bamboo should be planted outside the park	29
2.2.13 The dynamics of bamboo market in the region	20
3.2.14 Regularity of bamboo products use in tea cooperative members	20
3.2.15 Source of bamboo products used	21
3.2.16 Availability of bamboo products demand versus supply	21
3.2.17 Support in bamboo development	12
3.2.18 Degree of interest in bamboo development	13
3.2. 19 Needed interventions in bamboo development	13
3.2.20 Origin of bamboo for local community	14
3.2.21 Species preferred in bamboo collection	16
3.2.22 Availability and accessibility of bamboo market	15
3.2.23 Market of bamboo (where bamboo is sold)	19
3.2.24 Farmers who received training	10
3.2.25 Sources of planting materials (offsets)	14
3.2.26 Species used for propagation	17
3.2.27 Species preferred in bamboo propagation and why	17
3.2.28 Sources of bamboo as alternative when supply is insufficient	15
3.2.29 Potential of bamboo crop in comparison with others	8
3.2.30 Training on bamboo processing	10
3.2.31 Species preferred for processing	21
3.2.32 Products produced from bamboo	22
3.2.32 Where bamboo products are sold	23
3.2.33 Price for bamboo products	23
3.2.34 Greatest challenges in bamboo processing	23
3.2.35 Preference of bamboo materials	24
3.2.37 Interest variability from bamboo product	
VI. DISCUSSION OF DATA FINDINGS	
V. RECOMMENDATION Error! Bookmark no	ot defined.
VI. CONCLUSION	37
REFERENCES	39
ANNEXES	A

LIST OF FIGURES

Figure 1: Location of study	5
Figure 2: Status of bamboo market in surrounding zones of NNP	20
Figure 3: Bamboo in construction	30
Figure 4: Some bamboo species Error! Bookmark not de	efined.
Figure 5: Bamboo baskets	34
LIST OF TABLES	
Table 1: Categories of respondents	3
Table 2: Percentages of respondents by SectorsError! Bookmark not de	efined.
Table 3: Percentages of respondents by Cells	4
Table 4: Uses of bamboo	6
Table 5: Percentages of respondents by Sectors considering the subsistence usage of bamboo	7
Table 6: Bamboo for commercial purpose Error! Bookmark not de	efined.
Table 7: Suggestions	8
Table 8: Bamboo cutting in Nyungwe National Park	27
Table 9: Measures are taken to manage and prevent cutting in the Park	27
Table 10: Proportion on effectiveness of measures taken against bamboo illegal cuttin	ıg28
Table 11: Alternatives to bamboo cutting in the park	28
Table 12: Threat to the Plants and wildlife in the Park	29
Table 13: Partners in Bamboo development	11
Table 14: Success of Bamboo programs	12
Table 15: Where hamboo should be planted outside the park	30

Table 16: Regularity of bamboo product use in tea cooperative	20
Table 17: Source of bamboo products	21
Table 18: Availability of bamboo products demand versus supply	21
Table 19: Support of Bamboo development from the government or an NGO	12
Table 20: Interested in putting time into bamboo development	13
Table 21: Interventions in bamboo development	13
Table 22:The source of Bamboo	14
Table 23: Species preferred in bamboo to collection	16
Table 24: the Availability and accessibility of bamboo markets	18
Table 25: The place where bamboo are sold	26
Table 26: Members of bamboo growers who have received training	10
Table 27: The source of planting materials	16
Table 28: Species to use in bamboo propagation activities	17
Table 29: The preferred species	17
Table 30: Why Alundinaria Alpine (Green) is preferred	18
Table 31: The source of bamboo when the supply is insufficient	15
Table 32: Potential of bamboo crop in comparison with others	8
Table 33: Training on bamboo processing	11
Table 34: The species preferred for processing	22
Table 35: Products produced from bamboo	22
Table 36: where are your products sold	23
Table 37: Bamboo materials preferred in this region	24
Table 38: Buyers of bamboo products in different cells	24

Table	39: Comparis	on between bamboo products' price with other products2
Table	40: The inter	est in bamboo products20
ABBR	EVIATIONS A	AND ACRONYMS
1.	ARECO	: Association Rwandaise des Ecologistes
2.	BASOLI	: Bamboo promotion for Soil conservation and improved Livelihoods
	in the surro	anding zones of the volcanoes National park
3.	COTENK	:(COOPERATIVE Y'ABAHINZI B'ICYAYI NSHILI KIVU)
4.	WCS	: Wildlife Conservation Society
5.	NNP	: Nyungwe National Park
6.	NGO	: Non Gouvernement Organisation
7.	RNRA	: Rwanda Natural Resources Authority
8.	RDB	: Rwanda Development Board
9.	PAB	: Protected Areas Biodiversity

ABSTRACT

This study aimed at providing baseline information on the bamboo development potential around Nyungwe National Park (NNP). It was conducted in Ruheru, Busanze and Nyabimata Sectors of Nyaruguru District with the sample size of 256 respondents representing 6 categories of respondents including members of the local community, local leaders, members of bamboo processor's cooperatives, members of tea growers' cooperatives, bamboo products traders and bamboo growers. The results of this study showed that bamboo has a high development potential around NNP. People living in the area surrounding NNP especially in Nshili region use bamboo for different purposes including handcrafts making, construction, bean poles, and cash income. However local people need access to seedlings and to bamboo propagation and processing techniques and marketing to increase benefits from bamboo development. The prices of bamboo and bamboo products are still low compared to the cost to get them. This is mainly due to lack of techniques to improve the quality of the products and to increase the quantity and also the poor capacity of doing business.

Some partnerships were mentioned that helped to introduce bamboo in the area but there is a need of more interventions to develop bamboo in the area and reduce its illegal collection within the park. Local leaders are willing to assist in any program that can be developed and are already assisting in enforcing law to reduce illegal bamboo harvesting. Local people are willing to plan bamboo and t was suggested that bamboo be planted along rivers, along roads, in junctions of agricultural plots and if possible on public or private plots. Also some assistance to Kibira forest management is needed to reduce illegal bamboo there because most of bamboo sold on Rwandan side is reported to come from there and it was also mentioned that Burundian also started to cut bamboo in NNP in areas bordering with Kibira forest.

ACKNOWLEDGEMENT

The process of collecting data in 256 households involved many people from different institutions.

We thank the Government of Rwanda for permission to conduct this survey. Our special thanks go to WCS for the technical and financial support. We are very grateful to all those who participated in this survey including enumerators, supervisor as well as a driver. We recognize the efforts and commitment of those who were responsible of data entry and processing.

I. INTRODUCTION

ARECO RWANDA NZIZA is dedicated to saving environment and to restoring landscapes, in particular to assure a better future for threatened species and degraded soils. This mission is achieved through conservation programs that promote bamboo especially in Northern Province with the support of different partners and stakeholders including government and non government institutions. Since years, between ARECO and Wildlife Conservation Society (WCS), there is a partnership of collaboration to aid cross-sharing of experiences, information, and increasing the efficiency of different programs. It is in this framework that WCS provided a sub-grant to ARECO-RWANDA NZIZA to conduct a baseline study on bamboo development potential around NNP. ARECO RWANDA NZIZA coordinated all activities including field survey, data entry and processing as well as report writing.

NNP faces many threats caused mostly by the huge human population living around the park. Farmers encroach on the boundaries of the forest, leading to habitat fragmentation and reduction in park's natural resources. One of the most important threats is the illegal cut of bamboo. Bamboo has traditionally been used for construction, handicrafts, to support beans, and to make various household articles. Bamboo has also been recognized as a potential species for helping to control soil erosion. It is within this context that WCS in partnership with USAID under the project 'Sustaining Biodiversity Conservation in and around Nyungwe National Park' is developing a bamboo promotion program around Nyungwe National Park as an alternative resource outside the park.

The main objective of this study was to provide baseline information that can help WCS to understand whether there is a potential for bamboo development around NNP.

The specific objectives of this survey are:

- (1)To provide a realistic indication of bamboo production potential in community woodlots around Nyungwe;
- (2)To provide a realistic indication of the sustainable economic development potential (social and environmental) of bamboo;
- (3) To explain the value chain(s) in order to assess opportunities and bottlenecks for bamboo cultivation;
- (4) To assess whether and where an investment in bamboo cultivation will contribute significantly to the reduction in illegal harvesting of bamboo in NNP.

II. APPROACH AND METHODOLOGY

II.1 Sampling methods, data collection and analysis techniques

This research used a participatory approach that was based on socio-environmental histories of household livelihoods, and cross-sectional analyses about current related bamboo conflict between the park management and the local communities, bamboo market chain, vulnerability of NNP and forest management. Data were collected using interviews guided by a questionnaire. 256 respondents were randomly selected in Nyaruguru District, Ruheru, Busanze and Nyabimata Sectors, Cells of Kabere, Kirarangombe, Mishungero, Nkanda, Remera, Runyombyi, Ruyenzi and Shororo. The data were collected from 25 June 2012 to 03 July 2012.

We used the formula of Alain BOUCHARD to get and categorize the sample that was investigated. This formula was applied as follows:

For an infinite population (>1.000.000 individuals), with a margin error of 10% with the threshold of α = 0.05, i.e. a confidence interval of $Z\alpha$ =1.96

In the most unfavorable situation (p=q=1/2), the necessary sample size to estimate, with a given precision a percentage by simple random technique is equal to:

No=
$$(1.96)^2*0.5*0.5/(10/100)^2 = 96.04 \approx 96$$

With: α = level of significance

Z= normal probability distribution

E = error margin

pq =variance (p=q=1/2), estimate of unknown variance

N= total number of targeted farmers

n= sample size after correction of error, and on estimated population

No = sample size estimated to unknown population

If a population-mother is defined (<1,000,000 individuals), to obtain the corrected sample size, the given formula was used. The total number of population is 60 of bamboo processing cooperatives.

When we use the same formula to estimate the sample size of bamboo possessing members with the total of 60population of bamboo processors we have:

No
$$n = \frac{1 + No}{1 + No}$$

$$\sqrt{n} = \frac{96}{1 + 96} = \frac{37}{1 + 96}$$

The sample size is 37 respondents for bamboo processing cooperative members.

Using the same formulae of Alain Bouchard:

$$\sqrt{n} = 96/1 + 96/52 = 34$$

The sample size was found to be 34 of bamboo growers.

We thought to have the population of 79 of tea cooperatives; then the sample size is,

Randomly, we included 16 local leaders representing 6 cells and 2 sectors and 94 representatives of local communities.

We also randomly surveyed 30 people from bamboo traders.

The total sample size is: 95+37+34+44+16+30=256 respondents.

Table 1: Categories of respondents

	Frequency	Percent
Local Leader	16	6.3
Local Community	95	37.1
Cooperative Member	44	17.2
Bamboo Processor	37	14.5
Bamboo Growers	34	13.3
Bamboo Market	30	11.7
Total	256	100.0

Number of respondents per cell

This study was conducted in three sectors, which are Busanze, Nyabimata and Ruheru. Among 256 respondents, 81.3% were from Ruheru Sector, 17.6% were from Busanze Sector and 1.2% were from Nyabimata Sector. Ruyenzi and Uwumusebeya cells of Ruheru Sector covered a big number of the total respondents with 58, 2%. The reason is that these cells are the most adjacent to the forest meaning that more bamboo harvesters from NNP live in these cells.

Table 2: Percentages of respondents by Cells

Cells	Frequency	Percentages
Kabere	32	12.5%
Kirarangombe	24	9.4%
Mishungero	3	1.2%
Nkanda	17	6.6%
Remera	27	10.5%
Runyomyi	2	0.8%
Ruyenzi	83	32.4%
Shororo	2	0.8%
Uwumusebeya	66	25.8%
Total	256	100%

Data were entered in excel format and analyzed using SPSS.

II.2 DESCRIPTION OF THE STUDY AREA

Nyungwe is a high altitude, mountainous rainforest established as a Forest Reserve in 1933. The forest is located in the Albertine Rift, a series of mountain ranges beginning at the Rwenzori Mountains in western Uganda and Congo, continuing south into the Lendu Plateau in eastern Congo. Contiguous with Kibira National Park in Burundi, Nyungwe is one of the largest rainforests remaining in Africa. In 2005 the Nyungwe forest received National Park status, making it East Africa's largest protected high-altitude rainforest (WCS, 2009). Nyungwe National Park is located in South Western part of Rwanda. In the south, it borders with the republic of Burundi. In the East, it borders with Nyamagabe District and from south to north it shares a common border with Nyaruguru District. The survey was conducted in Ruheru, Busanze and Nyabimata Sectors. The selected cells within the three Sectors are: Kabere, Kirarangombe, Mishungero, Nkanda, Remera, Runyombyi, Ruyenzi and Shororo.



Figure 1: Location of the study

III. RESULTS

3.1 Bamboo production potential in community woodlots around NNP

3.1.1 Usages of bamboo

This research showed that people living around NNP use bamboo for households' subsistence and for commercial purposes. It was found that the most important usage of bamboo around NNP is handcrafts making as reported by 50% of respondents. 47.2% of respondents said that bamboo is used as construction material, 1.6% of respondents said that bamboo is sold at local markets to get income and 1.2% of respondents reported that bamboo is used as bean poles.

Table 2: Uses of bamboo

		Uses of bamboo				
	Handicrafts making	Bean poles	Construction materials	Sale at market	Total	
Ruheru	100	3	103	2	208	
	39%	1.2%	40.2%	0.8%	81.3%	
Busanze	25	0	18	2	45	
	9.8%	0%	6.2%	0.8%	17.6%	
Nyabimata	3	0	0	0	3	
	1.2%	0%	0%	0%	1.2%	
Total	128	3	121	4	256	
	50%	1.2%	47.2%	1.6%	100%	

3.1.2 Proportion of bamboo directly used by households

It has been shown that most of bamboo harvested in this region is used by the communities for household consumption. The table below shows the proportion of bamboo used for subsistence purposes by sectors. The importance of bamboo as a contribution on local consumption and commercial materials was shown by ranges in percentage. The table below shows that there is no range category from 0-10(%) for subsistence usage. This means that most of the people categorized bamboo as a local use material with high range of percentages. 21.1% of respondents said that bamboo is locally consumed with the range of 80-84% and 13.7% of respondents confirmed that bamboo is locally consumed with the range of 60-64% while 12.1% of respondents said that it is consumed with the range of 70-74%. This justifies how bamboo has a high production potential in community woodlots around NNP as local households use it for different purposes in their daily life.

Table 3: Percentages of respondents by Sectors considering the subsistence usage of bamboo

		Subsistence	purpose		
		Se	ector Name		
	Range	BUSANZE	NYABIMATA	RUHERU	Total
Subsistence	10-14(%)	0	0	1	1
		0.0%	0.0%	0.4%	0.4%
	15-19(%)	0	0	1	1
		0.0%	0.0%	0.4%	0.4%
	20-24(%)	1	0	3	4
		0.4%	0.0%	1.2%	1.6%
	25-29(%) 0 0	0	2	2	
		0.0%	0.0%	0.8%	0.8%
	30-34(%)	1	0	14	15
		0.4%	0.0%	5.5%	5.9%
	35-39(%)	0	0	3	3
	00 07 (70)	0.0%	0.0%	1.2%	1.2%
	40-44(%)	4	0	24	28
		1.6%	0.0%	9.4%	10.9%
	45-49(%)	0	0	2	2
		0.0%	0.0%	0.8%	0.8%
	50-54(%)	2	0	9	11
		0.8%	0.0%	3.5%	4.3%
	55-59(%)	0	0	2	2
		0.0%	0.0%	0.8%	0.8%
	60-64(%)	4	0	31	35
		1.6%	0.0%	12.1%	13.7%
	65-69(%)	0	0	4	4
		0.0%	0.0%	1.6%	1.6%
	70-74(%)	6	0	25	31
		2.3%	0.0%	9.8%	12.1%
	75-79(%)	7	0	20	27
		2.7%	0.0%	7.8%	10.5%
	80-84(%)	13	0	41	54
		5.1%	0.0%	16.0%	21.1%
	85-89(%)	1	1	14	16
		0.4%	0.4%	5.5%	6.3%
	>90(%)	6	2	12	20
		2.3%	0.8%	04.7%	7.8%
Total	1	45	3	208	256
- 		17.6%	1.2%	81.3%	100%

3.1.3 Potential of bamboo crop in comparison with others

On the question "In comparison with other crops, what is the potential of bamboo in this area" that was addressed to local bamboo growers, 61.8% of respondents answered that the potential of bamboo is medium and 35.3% of respondents said that bamboo has a high potential among other crops. Only one person answered that bamboo has a low potential in this region.

Table 4: Potential of bamboo crop in comparison with others

		Cell Name			
Levels	Remera	Ruyenzi	Uwumusebeya	Total	
High potential	1	6	5	12	
	2.9%	17.6%	14.7%	35.3%	
Medium potential	1	4	16	21	
	2.9%	11.8%	47.1%	61.8%	
Low potential	0	0	1	1	
	0.0%	0.0%	2.9%	2.9%	
Total	2	10	22	34	
	5.9%	29.4%	64.7%	100%	

3.1.4 Suggestions to increase bamboo availability in the region

When asked what they suggest to increase bamboo availability in the region, respondents suggested the provision of seedlings, bamboo nursery establishment, trainings in bamboo propagation and bamboo processing. Most of them mentioned that the land where bamboo can be planted is available but the issue remains how and where to get seedlings. Nurseries establishment was suggested by 39.45% of respondents, training on bamboo propagation and bamboo processing by 37.89% of respondents, financial support by 12.89% of respondents and land provision by 1.56% of respondents. Indeed, some of respondents also suggested that to increase bamboo availability around NNP, they need field visits by bamboo growers where bamboo has been successfully developed, provision of offsets for direct planting and implication of development partners.

Table 5: Suggestions

Suggestions	Frequency	Percentages
Seedlings(Nurseries)	101	39.45%
Training on propagation and processing	97	37.89%
Financial Support	33	12.89%
Land	4	1.56%
Others	31	12.10%
Total	266	100

3.2 Sustainable economic development potential of bamboo

3.2.1 Proportion of bamboo used for direct income generation.

On the question "what proportion of bamboo is used for commercial purposes" that was addressed to respondents of all 6 categories, most of the respondents categorized bamboo as a commercial material with low percentage ranges. For this category of use, ranges are stated from 0-4% and secondly 5-9% while these classifications were not found for local consumption of bamboo in this region. 21.9% of all respondents confirmed that bamboo is commercially consumed with the range of 20-24%, 13.7% of the respondents confirmed that it is commercially consumed with the range of 40-44% and only 0.40% said that it is commercially consumed with the range of 85-89%. This must be due to the fact that bamboo processing is not yet much developed in the area. It was mentioned above that most of respondents stressed that bamboo is mainly harvested for subsistence usages including handcrafts making, construction and bean poles.

Table 6: Bamboo for commercial purpose

	Cor	nmercial purpo	se		
		Sector Nan	ne		
	Range	BUSANZE	NYABIMATA	RUHERU	Total
Commercial	0-4(%)	1	0	0	1
		0.4%	0.0%	0.0%	0.4%
	5-9(%)	0	1	1	2
		0.0%	0.4%	0.4%	0.8%
	10-14(%)	5	2	14	21
		2.0%	0.8%	5.5%	8.2%
	15-19(%)	1	0	15	16
		0.4%	0.0%	5.9%	6.3%
	25-29(%)	15	0	41	56
		5.9%	0.0%	16.0%	21.9%
		5	0	19	24
		2.0%	0.0%	7.4%	9.4%
	30-34(%)	6	0	23	29
		2.3%	0.0%	9.0%	11.3%
	35-39(%)	0	0	4	4
		0.0%	0.0%	1.6%	1.6%
	40-44(%)	4	0	31	35
		1.6%	0.0%	12.1%	13.7%
	45-49(%)	0	0	1	1
		0.0%	0.0%	0.4%	0.4%
	50-54(%)	1	0	10	11
		0.4%	0.0%	3.9%	4.3%

	55-59(%)	0	0	2	2
		0.0%	0.0%	0.8%	0.8%
	60-64(%)	4	0	25	29
		1.6%	0.0%	9.8%	11.3%
	65-69(%)	0	0	3	3
		0.0%	0.0%	1.2%	1.2%
	70-74(%)	2	0	12	14
		0.8%	0.0%	4.7%	5.5%
	75-79(%)	0	0	2	2
		0.0%	0.0%	0.8%	0.8%
	80-84(%)	1	0	4	5
		0.4%	0.0%	1.6%	2.0%
	85-89(%)	0	0	1	1
		0.0%	0.0%	0.4%	0.4%
Total		45	3	208	256
		17.6%	1.2%	81.3%	100%

3.2.2 Farmers who received training

On the question "Have you received any training on bamboo nursery development" addressed to local bamboo growers, 88.2% of respondents said that they did not receive any training on bamboo development. Only 8.8% of respondents mentioned that they received some training in this domain.

Table 7: Members of bamboo growers who received training

		Cell Name			
		Remera	Ruyenzi	Uwumusebeya	Total
Have you	Yes	0	1	2	3
received any		0.0%	2.9%	5.9%	8.8%
training on	No	2	9	19	30
bamboo		5.9%	26.5%	55.9%	88.2%
development	Noanswer	0	0	1	1
		0.0%	0.0%	2.9%	2.9%
Total		2	10	22	34
		5.9%	29.4%	64.7%	100%

3.2.3 Training on bamboo processing

Generally, bamboo is traditionally processed in Rwanda. Interviewees' responses about the training on bamboo processing showed that 91.9% of bamboo processors did not receive trainings on processing of bamboo and only 8.1% have received them. It is very important

to note that end-to-end value chains from growing to processing to marketing with support infrastructure and financing could be put into place. Doing spot activities such as training, or Setting up a processing centre were seemingly visible but wasted investments or investments with poor returns because there is no enough bamboo plantation ready for harvesting and processing.

Table 8: Training on bamboo processing

		Cell Name			
		Kabere	Ruyenzi	Uwumusebeya	Total
Training on bamboo	Yes	0	2	1	3
processing		0.0%	5.4%	2.7%	8.1%
	No	30	4	0	34
		81.1%	10.8%	0.0%	91.9%
	Total	30	6	1	37
		81.1%	16.2%	2.7%	100%

3.2.4 Partners in bamboo planting outside the park

62.5% of respondents from local leaders reported that they had no partners in bamboo development. However 37.5% of their colleagues said that different partners assisted in promotion of bamboo during some past years.

Table 9: Partners in bamboo development

		Partners in ba	mboo planting	Total
		Yes	No	
Sector Name	Busanze	1	5	6
		6.3%	31.3%	37.5%
	Ruheru	5	5	10
		31.3%	31.3%	62.5%
Total		6	10	16
		37.5%	62.5%	100%

3.2.5 Success of bamboo programs in surrounding zones of NNP

On the question about how successful were programs of bamboo development in the area, 62.5% of respondents from local leaders provided no answer to this question, 18.8% of respondents stressed that the performance of these programs was good, 12.5% said that the performance was excellent and 6.3% said that their performance was not good. The reason that local leaders were skeptical about the success of bamboo development programs in the area was that the bamboo programs that were developed in the area did

not leave a big impact in the area mainly because they were not based on local community needs. For instance bamboo programs gave local people *Bambusa vulgaris* (yellow bamboo), an exotic bamboo species that does not grow well in the region instead of *Alundinalia alpina* (Green bamboo), a local bamboo of NNP that is preferred by local people because of its rapid growth. Local people reported that they want to uproot *Bambusa vulgaris* planted in their plots and replace it with *Alundinalia alpina*.

Table 10: Success of Bamboo programs

How successful have these programs been							
		Frequency	Percent				
Valid	Excellent	2	12.5%				
	Good	3	18.8%				
	Not good	1	6.3%				
Missing	No answer	10	62.5%				
	Total	16	100%				

3.2.6 Support in bamboo development

Members of tea growers cooperatives were also asked if they were supported to plant bamboo as they are main users of handcrafts made in bamboo (baskets) to collect tea. 97.7% of respondents said that they did not receive any support for the sustainability of bamboo program in this region and 2.3% of respondents mentioned that they were not aware if there was any support received previously by their cooperatives to support bamboo plantation in surrounding zones of NNP especially in Ruheru and Busanze sectors.

Table 11: Support of Bamboo development from the government or an NGO

Is	Is there any support received for bamboo development?							
		Cell Name						
		Mishungero	Ruyenzi	Uwumusebeya	Total			
Support for	No	3	30	10	43			
bamboo		6.8%	68.2%	22.7%	97.7%			
development	Unsure	0	1	0	1			
		0.0%	2.3%	0.0%	2.3%			
Total		3	31	10	44			
		6.8%	70.5%	22.7%	100%			

The table above shows that the previous and present support in bamboo development around NNP is very low. There is a need to invest in this field because local people are very willing to develop this crop and this will reduce the pressure they put on the park ij such of bamboo. The support should be oriented in bamboo propagation and bamboo processing.

3.2.7 Degree of interest in bamboo development

On the question whether members of tea growers cooperatives are interested in developing planting bamboo and processing it, 95.5% of respondents said that they will be happy to invest their time and efforts in bamboo development activities. Only 4.5% of respondents were not sure if they will like to do it or not because there are no clear opportunities in this activity.

Table 12: Interest in putting time into bamboo development

		Cell	Name		
	Answers	Mishungero	Ruyenzi	Uwumusebeya	Total
Are you	Yes	3	30	9	42
interested in		6.8%	68.2%	20.5%	95.5%
bamboo	Unsure	0	1	1	2
development		0.0%	2.3%	2.3%	4.5%
Total		3	31	10	44
		6.8%	70.5%	22.7%	100%

3.2.8 Interventions needed in bamboo development

A number of bamboo development interventions needed locally have been reported by members of tea growers' cooperatives. The most intervention needed is bamboo planting that was mentioned by 54.8% of respondents. 40.5% of respondents said that the intervention needed is establishment of bamboo nurseries and 6.8% of respondents did not say anything about interventions needed. This must be due to low level of knowledge on bamboo propagation and processing. The table below shows proportions of different options of interventions in bamboo development.

Table 13: Interventions needed in bamboo development

What is wanted first to be done							
		Cell Name					
	Mishungero	Ruyenzi	Uwumusebeya	Total			
Nursery establishment	2	13	2	17			
	4.8%	31.0%	4.8%	38.6.5%			
Direct bamboo planting	1	16	6	23			
	2.4%	38.1%	14.3%	52.2%			
Others	0	1	0	1			
	0.0%	2.4%	0.0%	2.3%			
No answer	0	0	3	3			
	0.0%	0.0%	2.4%	6.8%			
Total	3	30	9	44			
	7.1%	71.4%	21.4%	100%			

3.3 The value chain of bamboo around NNP

3.3.1 Origin of bamboo for local community

Members of the local community were asked where they get bamboo from. 41.1 % of respondents answered that they get it from their own agricultural plots, 21.1% of respondents said that they get bamboo from their own agricultural plots and from Burundi and 8.4% of respondents said that they get bamboo for NNP. Regarding that the NNP is protected and that local people know well that harvesting bamboo there is illegal it is obvious that people who harvest collect bamboo I this park are more than this percentage above.

Table 14: Source of bamboo

	Where	do you col	lect bamb	00		
			Cell Nam	e		
	Kirarangombe	Nkanda	Remera	Ruyenzi	Uwumusebeya	Total
Inside the park	0	0	0	0	1	1
	0.0%	0.0%	0.0%	0.0%	1.1%	1.1%
Outside the park	2	0	0	1	0	3
	2.1%	0.0%	0.0%	1.1%	0.0%	3.2%
In your community	5	6	10	5	13	39
	5.3%	6.3%	10.5%	5.3%	13.7%	41.1%
Burundi	0	2	0	0	0	2
	0.0%	2.1%	0.0%	0.0%	0.0%	2.1%
Others	0	1	0	0	1	2
	0.0%	1.1%	0.0%	0.0%	1.1%	2.1%
Inside& Outside of	0	0	2	0	1	3
the Park	0.0%	0.0%	2.1%	0.0%	1.1%	3.2%
Inside the Park& In	0	1	2	4	1	8
your Community	0.0%	1.1%	2.1%	4.2%	1.1%	8.4%
Inside the park and	0	0	1	0	0	1
Other	0.0%	0.0%	1.1%	0.0%	0.0%	1.1%
Outside the park& In	1	1	2	6	2	12
your community	1.1%	1.1%	2.1%	6.3%	2.1%	12.6%
Outside the park&	0	0	1	2	0	3
Burundi	0.0%	0.0%	1.1%	2.1%	0.0%	3.2%
In your Community&	13	3	3	1	0	20
Burundi	13.7%	3.2%	3.2%	1.1%	0.0%	21.1%
Burundi& Other	0	1	0	0	0	1
	0.0%	1.1%	0.0%	0.0%	0.0%	1.1%
Total	21	15	21	19	19	95
	22.1%	15.8%	22.1%	20.0%	20.0%	100%

3.3.2 Sources of bamboo as alternative when supply is insufficient

Around Nyungwe, bamboo ready to use for construction and processing is not sufficient. Therefore bamboo developers were asked where bamboo users obtain the addition of bamboo needed for their dairy bamboo related activities. Cooperatives and Home gardens were reported to be the source of bamboo used in this region with the percentage of 25.0%. Growers of bamboo also classified NNP and Burundi as the second importance source of bamboo when the supply is very low and Burundi it was appointed by 12.5% of bamboo growers to be the main source of bamboo used in Ruheru and Busanze Sectors.

Table 15: The source of bamboo when the supply is insufficient

Source	Cell Name				
	Remera	Ruyenzi	Uwumusebeya	Total	
Other cooperatives	0	1	0	1	
	0.0%	6.3%	0.0%	6.3%	
Home gardens	0	1	0	1	
	0.0%	6.3%	0.0%	6.3%	
Burundi	0	0	2	2	
	0.0%	0.0%	12.5%	12.5%	
Cooperatives and Home gardens	0	1	3	4	
	0.0%	6.3%	18.8%	25.0%	
Cooperatives and Park	0	0	1	1	
	0.0%	0.0%	6.3%	6.3%	
Cooperatives and Burundi	0	0	2	2	
	0.0%	0.0%	12.5%	12.5%	
Home gardens and Park	0	1	0	1	
	0.0%	6.3%	0.0%	6.3%	
Home gardens and Burundi	1	0	0	1	
	6.3%	0.0%	0.0%	6.3%	
Inside the Park and Burindi	0	0	3	3	
	0.0%	0.0%	18.8%	18.8%	
Total	1	4	11	16	
	6.3%	25.0%	68.8%	100%	

3.3.3 Sources of planting materials (offsets)

The majority of respondents (23.5% respectively) from local bamboo growers said that they get bamboo offsets either from local market or get them independently. Only 5.9% of respondents said that they purchase bamboo offsets from dealers, 2.9% of respondents said

that they get them from other sources while other 2.9% did not wish to mention something on this question. This shows that there are no bamboo nurseries in the area.

Table 16: The source of planting materials

		Cell Name			
		Remera	Ruyenzi	Uwumusebeya	Total
Where do	Purchase at local market	0	3	5	8
you obtain		0.0%	8.8%	14.7%	23.5%
your planting	Purchase from dealers	0	2	0	2
materials		0.0%	5.9%	0.0%	5.9%
	Gather independently	0	2	6	8
		0.0%	5.9%	17.6%	23.5%
	Other	0	0	1	1
		0.0%	0.0%	2.9%	2.9%
	Missing	0	1	0	1
		0.0%	2.9%	0.0%	2.9%
	Purchase at local market and purchase from dealers	0	1	4	5
		0.0%	2.9%	11.8%	14.7%
	Purchase at local market and	1	1	5	7
1	gather independently	2.9%	2.9%	14.7%	20.6%
	Purchase at local market and	0	0	1	1
	Other	0.0%	.0%	2.9%	2.9%
	Purchase from dealers Gather	1	0	0	1
	independently	2.9%	0.0%	0.0%	2.9%
Total		2	10	22	34
		5.9%	29.4%	64.7%	100%

3.3.4 Species preferred in bamboo collection

95.8% of respondents from the members of the local community said that *Arundinalia alpina* is the only species that they prefer in bamboo collection, 2.1% said that they prefer *Bambusa vulgaris* while other 2.1% of respondents said that they like both *Arundinalia alpine* and *Bambusa vulgaris*.

Table 17: Species preferred in bamboo collection

		Cell Name				
	Kirarangombe	Nkanda	Remera	Ruyenzi	Uwumusebeya	Total
Bambusa vulgaris	0	0	1	1	0	2
(yellow)	0.0%	0.0%	1.1%	1.1%	0.0%	2.1%
Arundinalia alpina	21	15	20	17	18	91
(green)	22.1%	15.8%	21.1%	17.9%	18.9%	95.8%
Combination	0	0	0	1	1	2
	0.0%	0.0%	0.0%	1.1%	1.1%	2.1%
Total	21	15	21	19	19	95
	22.1%	15.8%	22.1%	20.0%	20.0%	100%

3.3.5 Species used in bamboo propagation

During this study both *Alundinaria* and *Bambusa vulgaris* were mentioned *to* be used in propagation activities with the proportion of 67.6% of respondents from local bamboo growers. *Alundinaria Alpina* was mentioned to be used for propagation by 20.6% of respondents while *Bambusa Vulgaris* was reported to be used for propagation by 11.8% of respondents.

Table 18: Species used in bamboo propagation

		Cell Name	Cell Name		
		Remera	Ruyenzi	Uwumusebeya	Total
Species used for	Alundinaria Alpina	1	2	4	7
bamboo		2.9%	5.9%	11.8%	20.6%
propagation	Bambusa Vulgaris	0	2	2	4
		0.0%	5.9%	5.9%	11.8%
	Alundinaria and	1	6	16	23
	Bambusa vulgaris	2.9%	17.6%	47.1%	67.6%
Total		2	10	22	34
		5.9%	29.4%	64.7%	100%

3.3.6 Species preferred in bamboo propagation and why

Today, the area of surroundings zone of NNP is probably some of the most planted with bamboo in Rwanda, thanks to interventions of various partners. Many households planted both *Alundinaria Alpina* (Green) and *Bambusa Vulgaris* but when it comes to select species according to the level of preference, 100% of them reported *Alundinaria Alpina* to be preferred for bamboo propagation.

Table 19: The preferred species

	Remera	Ruyenzi	Uwumusebeya	Total

Species preferred	Alundinaria Alpina	2 5.9%	10 29.4%	22 64.7%	34 100%
Total		2	10	22	34
		5.9%	29.4%	64.7%	100%

Alundinaria Alpine (Green) is preferred due to its high success in development, disease resistance and how it is easy to obtain its planting materials. 55.9% prefer this species because of its vigor and high success in development of this species. 38.2% of bamboo growers declared that apart from success in development, for *Alundinaria* is easy to get when it is needed for propagation. 5.9% of bamboo growers combined two aspects of success in development and disease resistance to justify why they prefer *Alundinaria* Alpine.

Table 20: Why Alundinaria Alpina (Green) is preferred

		Cell Name			
		Remera	Ruyenzi	Uwumusebeya	Total
Why	High success in development	2	6	11	19
		5.9%	17.6%	32.4%	55.9%
	Success in development and disease	0	0	2	2
	resistance	0.0%	0.0%	5.9%	5.9%
	Success in development and Easy to	0	4	9	13
	obtain planting materials		11.8%	26.5%	38.2%
Total	·	2	10	22	34
		5.9%	29.4%	64.7%	100%

3.3.7 Availability and accessibility of bamboo market

On the question whether bamboo markets are available and accessible, 55.8% of respondents from the members of the local community reported that bamboo markets are not available and not accessible in the region and 40.0% of respondents said that markets are available and easily accessible. The table below shows the proportion related to bamboo markets and accessibility of markets.

Table 21: Availability and accessibility of bamboo markets

Cell Name							
		Kirarangombe	Nkanda	Remera	Ruyenzi	Uwumusebeya	Total
Are	Yes	2	8	11	12	5	38
markets		2.1%	8.4%	11.6%	12.6%	5.3%	40%

for your	No	19	5	9	6	14	53
bamboo		20.0%	5.3%	9.5%	6.3%	14.7%	55.8%
available	Unsure	0	1	1	1	0	3
and		0.0%	1.1%	1.1%	1.1%	0.0%	3.2%
accessible	Missing	0	1	0	0	0	1
		0.0%	1.1%	0.0%	0.0%	0.0%	1.1%
Total		21	15	21	19	19	95
		22.1%	15.8%	22.1%	20%	20%	100%

3.3.8 Markets of bamboo and bamboo products

After assessing bamboo market availability, we wished to know where exactly bamboo collected and products processed from it were sold. It was mainly reported that bamboo products were sold in Nyanza, southern province and on local markets. 47.4% of respondents from bamboo processors said that the main buyers of bamboo and bamboo products are local households and bamboo processors and 23.7% of respondents reported that local households are the main buyers of bamboo and bamboo products. 10.5% of respondents said that bamboo and bamboo products are sold on local markets and also directly to local households and other 10.5% of respondents reported that bamboo and bamboo products are sold on local markets and to bamboo processors. Small number of 7.9% of respondents mentioned that bamboo and bamboo products are bought by local bamboo processors and handcrafts' makers. None of respondents mentioned that bamboo is sold in Burundi.

Table 22: The place where bamboo are sold

		Cell	Name			
	Kirarangombe	Nkanda	Remera	Ruynzi	Uwumusebeya	Total
Local	0	3	3	3	0	9
communities	0.0%	7.9%	7.9%	7.9%	0.0%	23.7%
Processors/Han	1	1	0	1	0	3
dcraft makers	2.6%	2.6%	0.0%	2.6%	0.0%	7.9%
Burundi	0	0	0	0	0	0
	0.0%	0.0%	0.0%	0.0%	0.0%	0%
Community	1	2	6	5	4	18
&Processors	2.6%	5.3%	15.8%	13.2%	10.5%	47.4%
Community	0	1	0	2	1	4
&Local Market	0.0%	2.6%	0.0%	2.6%	2.6%	10.5%
Processors	0	1	1	2	0	4
&Local Market	0.0%	2.6%	2.6%	5.3%	0.0%	10.5%
Total	2	8	11	12	5	38
	5.3%	21.1%	28.9%	31.6%	13.2%	100%

3.3.9 Dynamics of bamboo market in the region

The current status of bamboo market in surrounding zones of NNP was the one of this baseline study targets. While investigating on this situation, 70% of the respondents confirmed that bamboo market is still increasing and 20% said that the bamboo market is staying the same over time while 10% declared that the bamboo market is now decreasing. The driving forces of the bamboo market dynamics is the availability of bamboo itself and bamboo processing technology in particularly for the region.

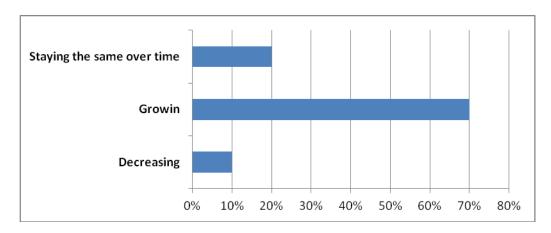


Figure 2: Status of bamboo market in surrounding zones of NNP

3.3.10 Regularity of bamboo products use in tea cooperative members

According to COTENK (COOPERATIVE Y'ABAHINZI B'ICYAYI NSHILI-KIVU) cooperative members, baskets made in bamboo are mainly used for tea harvesting activities. They are preferred because they are easy for transport when harvesting and they are durable compared to others. 86.4% of respondents from the members of tea growers' cooperatives (38 out of 44 tea cooperative members) declared that bamboo products are regularly used in their day to day activities and 9.1% of them said that they don't use bamboo products regularly. The remaining part of 4.5 % said that they were not sure about the regularity of bamboo use in their everyday life.

Table 23: Regularity of bamboo product use in tea cooperative

		Do you use baml	Do you use bamboo regularly				
		Yes	No	Unsure	Total		
Cell	MISHUNGERO	3	0	0	3		
Name		6.8%	0%	0%	6.8%		
	Ruyenzi	25	4	2	31		
		56.8%	9.1%	4.5%	70.5%		
	Uwumusebeya	10	0	0	10		
		22.7%	0.0%	0.0%	22.7%		
Total		38	4	2	44		
		86.4%	9.1%	4.5%	100%		

3.3.11 Source of bamboo products used

(86.4%) of respondents from tea growers' cooperatives reported that the main source of bamboo products that they use (mainly baskets) are bought from local markets. 11.4% of the respondents from the category said that they come from handcrafts making cooperatives and 2.3% of these respondents mentioned that the bamboo products that they use come from other sources.

Table 24: Source of bamboo products

Source	Mishungero	Ruyenzi	Uwumusebeya	Total
Local market	3	26	9	38
	6.8%	59.1%	20.5%	86.4%
Cooperative	0	5	0	5
members	0.0%	11.4%	0.0%	11.4%
Others	0	0	1	1
	0.0%	0.0%	2.3%	2.3%
Total	3	31	10	44
	6.8%	70.5%	22.7%	100%

3.3.12 Availability of bamboo products demand versus supply

The table below shows that 95.5% of the respondents said that bamboo products supply is meeting demand of these products. Only 4.5% declared that the supply of bamboo products is sufficient to meet the demand of them.

Table 25: Availability of bamboo products demand versus supply

	Is the bamboo products available					
Answers	Mishungero	Ruyenzi	Uwumusebeya	Total		
No	3	29	10	42		
	6.8%	65.9%	22.7%	95.5%		
Unsure	0	2	0	2		
	0.0%	4.5%	0.0%	4.5%		
Total	3	31	10	44		
	6.8%	70.5%	22.7%	100%		

3.3.13 Species preferred for processing

Results of this study showed that *Alundinaria* is the most preferred specie for processing with 97.3% of all bamboo processors and only 2.7% declared to prefer *Bambusa Vulgaris* for bamboo processing activities.

Table 26: The species preferred for processing

	Which species do you prefer for processing						
Cells	Bambusa Vulgaris	Alundinaria Alpina	Total				
KABERE	0	30	30				
	0.0%	81.1%	81.1%				
Ruyenzi	0	6	6				
	0.0%	16.2%	16.2%				
Uwumuseb	1	0	1				
eya	2.7%	0.0%	2.7%				
Total	1	36	37				
	2.7%	97.3%	100%				

3.3.14 Products produced from bamboo

Generally, key products from bamboo processing are: diverse baskets, mats and Construction materials etc. Commoditized primary processed bamboo inputs like Small tools and small machines are used. During this study, 40.5% of respondents from bamboo processing cooperatives reported that they use bamboo for construction and handcrafts making, 24.3% of these respondents said that they use bamboo to make handicrafts (baskets, chairs, tables, etc) and construction materials respectively, 2.7% o respondents said that they use bamboo for bean poles while 8.1% said that they use bamboo for bean poles and bean poles.

Table 27: Products produced from bamboo

	What produ	cts do you	bamboo			
		Bean	Construction	Handicraft and bean	Handicraft and Construction	Total
	Handicrafts	poles	materials	poles		
KABERE	6	1	6	2	15	30
	16.2%	2.7%	16.2%	5.4%	40.5%	81.1%
Ruyenzi	2	0	3	1	0	6
	5.4%	0.0%	8.1%	2.7%	0%	16.2%
Uwumusebe	1	0	0	0	0	1
ya	2.7%	0.0%	0.0%	0.0%	0%	2.7%
Total	9	1	9	3	15	37
	24.3%	2.7%	24.3%	8.1%	40.5%	100%

3.3.15 where bamboo products are sold

During this study 38.7% of respondents from bamboo processors said that they sell their products both on local markets and to local households, 38.7% of these respondents said that they sell their processed products only on the local market and 19.4% reported that they sell their products to local households.

Table 28: where are your products sold

	W	here are your			
	Local community	Local markets	Local markets and Local communities	Local markets and Burundi	Total
KABERE	6	7	10	1	24
	19.4%	22.6%	32.3%	3.2%	77.4%
Ruyenzi	0	4	2	0	6
	0.0%	12.9%	6.5%	0%	19.4%
Uwumusebeya	0	1	0	0	1
	0.0%	3.2%	0.0%	0.0%	3.2%
Total	6	12	12	1	31
	19.4%	38.7%	38.7%	3.2%	100%

3.3.16 Price for bamboo products

During this baseline study, interviewees were asked if they receive a fair price for their bamboo products. All bamboo processors said that the price was not fair at all. It has been reported that bamboo markets are not available and accessible in surrounding zone of NNP. Although it is not available, bamboo products are commonly used for construction, tea harvesting and wedding ceremonies but there are no specific plantations where bamboo raw materials are obtained. This explains how production cost of bamboo products is very high but the price is still the same and sometimes decreasing depending on different circumstances including seasons.

3.3.17 Greatest challenges in bamboo processing

This section showed the greatest challenges in bamboo processing. Bamboo processors were asked to identify different challenges met during bamboo processing activities. It has been reported by most of them with 35.1% that raw materials and low markets availability are the greatest challenges for processing in surrounding zones of NNP (Annex 6). Other challenges such as low capacity of production due the traditional processing and lack of bamboo processing centers were also identified. Access to the markets, raw materials availability and low capacity of production as challenges in bamboo processing does seem to have some impacts on wealthy creation.

3.3.18 Preference of bamboo materials

The table below shows the level of preference of bamboo products in zones of NNP. 96.7% of bamboo products traders confirmed that these products are so much preferred in everyday life of communities. Only 3.3% were not sure whether bamboo products are preferred or not.

Table 29: Bamboo materials preferred in this region

	Are bamboo materia		
Cell name	Yes	Unsure	Total
Kirarangombe	1	0	1
	3.3%	0.0%	3.3%
Remera	1	0	1
	3.3%	0.0%	3.3%
Ruyenzi	13	1	14
	43.3%	3.3%	46.7%
Shororo	2	0	2
	6.7%	0.0%	6.7%
Uwumusebeya	12	0	12
	40.0%	0.0%	40.0%
Total	29	1	30
	96.7%	3.3%	100%

3.3.19 Bamboo buyers

The tables below shows different buyers of bamboo products processed in this region. It has been reported that products are sold to local communities in both surrounding cells. These products are then used for local purpose of the population.

Table 30: Buyers of bamboo products in different cells

	To whom do	you sell the p	products			
	Cell Name					
	Kirarangombe	Remera	Ruyenzi	Shororo	Uwumusebeya	Total
Local communities	1	1	13	1	12	28
	3.3%	3.3%	43.3%	3.3%	40.0%	93.3%
Others(Brides, Visitors, etc)	0	0	0	1	0	1
	0.0%	0.0%	0.0%	3.3%	0.0%	3.3%
Local community	0	0	1	0	0	1
and others	0.0%	0.0%	3.3%	0.0%	0.0%	3.3%

Total	1	1	14	2	12	30
	3.3%	3.3%	46.7%	6.7%	40.0%	100.0%

3.3.30 Comparison between bamboo products' price with others

Bamboo traders were first asked to compare bamboo products' price with other alternative products. This was a gender based question where 70.0% of men reported bamboo products to be of medium price and 30.0% of them said that bamboo products are expensive compare to others. As it is shown in table below, women classified bamboo as products of Medium price with 80.0% while 20.0% of women said that bamboo products are expensive. Generally bamboo products are not too much expensive but their price is medium compare to others.

Table 31: Comparison between bamboo products' price with other products

		Compare bamboo products' price with other products		
Sex		Expensive	Medium	Total
Male	Kirarangombe	1	0	1
		5.0%	0.0%	5.0%
	Ruyenzi	2	8	10
		10.0%	40.0%	50.0%
	Shororo	1	1	2
		5.0%	5.0%	10.0%
	Uwumusebeya	2	5	7
		10.0%	25.0%	35.0%
Tota	Total	6	14	20
		30.0%	70.0%	100.0%
Female	Remera	0	1	1
		0.0%	10.0%	10.0%
	Ruyenzi	1	3	4
		10.0%	30.0%	40.0%
	Uwumusebeya	1	4	5
		10.0%	40.0%	50.0%
	Total	2	8	10
		20.0%	80.0%	100.0%

3.3.21 Interest variability from bamboo product

Given to the nature of questions asked in this section, it pays to be careful when assessing the value chain of bamboo in surrounding zones of NNP. The study investigated how dynamics in interest from bamboo products is. It is clear from these results that both men and women confirmed that the interest related bamboo products is increasing.

Table 32: The interest in bamboo products

The table below shows that 95.0% of men and 90.0% of women saw that interest in bamboo products is increasing. Only 5.0% of men and 10.0% of women said the interests from bamboo products stay the same over time but there is not respondent who said that the interest is decreasing.

			Is the inte	rest in bamboo products	
Sex			Increasing	Staying the same over time	Total
Male	Cell	Kirarangombe	1	0	1
	Name	ame	5.0%	0.0%	5%
		Ruyenzi	9	1	10
			45.0%	5.0%	50%
		Shororo	2	0	2
			10.0%	0.0%	10%
		Uwumusebeya	7	0	7
			35.0%	0.0%	35%
		Total	19	1	20
			95.0%	5.0%	100%
Female	Cell	Remera	1	0	1
	Name	lame	10.0%	0.0%	10%
		Ruyenzi	3	1	4
			30.0%	10.0%	40%
		Uwumusebeya	5	0	5
			50.0%	0.0%	50%
		Total	9	1	10
			90.0%	10.0%	100%

3.4 Whether and where an investment in bamboo cultivation will contribute significantly to the reduction in illegal harvesting of bamboo in NNP

3.4.1 Severity of bamboo cutting in NNP

One of objectives of this assessment was to understand the severity of bamboo cutting in the region. The results of this study showed that 81.3% of the respondents confirmed that bamboo cutting is a crucial problem for conservation and protection of the Park. As the

target group for this question was local leaders who are involved in day to day park protection activities, this explained the really situation of bamboo cutting inside the park.

81.3% of the respondents (13 Local leaders) said that cutting bamboo inside the Park is still a problem even if it is yet protected, 12.5% have said that now there is no severe cutting of bamboo inside the park while 6.3% are not sure whether it is a problem or not.

Table 33: Bamboo cutting in NNP

		Problem of bamboo cutting in Nyungwe National Park			
		Yes	No	Unsure	Total
Busanze	Count	6	0	0	6
	% of Total	37.5%	0.0%	0.0%	37.5%
Ruheru	Count	7	2	1	10
	% of Total	43.8%	12.5%	6.3%	62.5%
	Count	13	2	1	16
	Total	81.3%	12.5%	6.3%	100.0%

3.4.2 Measures taken to manage and prevent cutting NNP

The main driver of bamboo based deforestation is the demand for fuel wood, handcraft making and construction activities. NNP, being protected by law, all community based activities including bamboo cutting inside the Park is done illegally. It has been reported by 53.8% of the total respondents that confiscation of cut bamboo is one of the measures taken to manage and prevent this illegal cutting of bamboo inside the park. Both fines and arrests came to the second round, each with 23.1% of the total number of respondents.

Table 34: Measures are taken to manage and prevent cutting in the Park

		Measures to manage and prevent cutting in the park			
		Fines	Fines Arrests Confiscation of cut bamboo		Total
Busanze	Count	1	0	5	6
	% of Total	7.7%	0.0%	38.5%	46.2%
Ruheru	Count	2	3	2	7
	% of Total	15.4%	23.1%	15.4%	53.8%
Total	Count	3	3	7	13
	% of Total	23.1%	23.1%	53.8%	100.0%

3.4.3 Effectiveness of measures taken

After this assessment on the measures against illegal cutting of bamboo inside the park, the study tried to evaluate the effectiveness of the measures taken. It has is reported by 68.7.% that all measures taken are Ineffective while 12.5% said that the measures against bamboo

cutting inside the park are effective but 18.8% did not say anything about these measures taken.

Table 35: Proportion on effectiveness of measures taken against bamboo illegal cutting

		How effective are these r	How effective are these measures?		
		Ineffective	Effective	No answer	Total
Sector	BUSANZE	6	0	1	7
Name		37.5	0.0%	6.3%	43.8%
	RUHERU	5	2	2	9
		31.2%	12.5%	12.5%	56.2%
	Total	11	2	3	16
		68.7.%	12.5%	18.8%	100%

3.4.4 Suggestions on alternatives to bamboo cutting inside the park

In order to enhance bamboo development in broadening economic and environment opportunities for the benefits of NNP surrounding population through diversification of bamboo and bamboo products sources, different suggestions on alternatives to bamboo cutting inside the Park were collected and analyzed during data analysis. The table below shows that bamboo cultivation is the major solution of a high bamboo demand of the people in the study area with 50.0% of the local leaders. 37.5% of the respondents suggested that bamboo should be collected outside the Part. This comes to emphasize again that the land under bamboo cover has to increase with the regard to bamboo supply versus bamboo demand.

Table 46: Alternatives to bamboo cutting in the park

		Alternatives to ba	Alternatives to bamboo cutting in the park				
		Outside	Bamboo Cultivation	Other	Total		
Sectors	Busanze	1	3	2	6		
		6.3%	18.8%	12.5%	37.5%		
	Ruheru	5	5	0	10		
		31.3%	31.3%	0.0%	62.5%		
Total		6	8	2	16		
		37.5%	50.0%	12.5%	100%		

3.4.5 Impact of cutting (threats) to plants and wildlife in the park

Bamboos are distinct and fascinating plants, with a wide range of values and uses. They play a significant role in biodiversity conservation and contribute to soil and water management. They are important for biomass production and play an increasing role in local and regional economies. This study used an innovative approach to know whether, according to the local

leaders, bamboo cutting can cause negative impact to plants or wildlife inside the park. 93.8% respondents confirmed that bamboo cutting causes a significant threat to the plants and wildlife in the park.

The remaining group of people 6.3% was not aware about disturbance of plants and animals due to bamboo cutting. Results showed that no one of respondents has said that bamboo cutting has no impact to plants and wildlife in the park.

Table 37: Threat to the Plants and wildlife in the Park

Signi	Significant threat to the plants and wildlife in the park								
		Yes	Unsure	Total					
Sector Name	Busanze	5	1	6					
		31.3%	6.3%	37.5%					
	Ruheru	10	0	10					
		62.5%	0.0%	62.5%					
Total		15	1	16					
		93.8%	6.3%	100%					

Respondents highlighted different animals which are threatened such ibihinyage, ibyondi, inkoto and invenzi, living inside the park and depending on bamboo plantation to survive.

3.4.6 Where bamboo should be planted outside the park

On the question "where do you suggest that bamboo should be planted outside the park" addressed to local leaders, respondents indicated that places suitable for bamboo planting are along rivers, along roads and few of them answered that bamboo should be planted in the junction of two agricultural plots from two different owners. 83.3% of respondents in Busanze Sector said that bamboo should be planted along rivers, 70.0% of respondents in Ruheru Sector said that bamboo should be planted along rivers, 20.0% of respondents in Ruheru Sector said that bamboo should be planted along the roads and 10.0% of respondents in Ruheru Sector said that bamboo should be planted in junctions of two different farms.

	Cell Name							
		Kirarang	Nkand				Uwumuse	
Kabere		ombe	a	Remera	Runyombyi	Ruyenzi	beya	Total
B Along		2	1		2			5
U rivers		33.3%	16.7%		33.3%			83.3%
S Other		0	1		0			1
A N		0.0%	16.7%		0.0%			16.7%
7.		2	2		2			6
E		33.3%	33.3%		33.3%			100%

R	Along	2		2	2	1	7
U	rivers	20.0%		20.0%	20.0%	10.0%	70%
H	Along	0		1	0	1	2
R R	roads	0.0%		10.0%	0.0%	10.0%	20%
U	Junctio	0		0	1	0	1
	ns	0.0%		0.0%	10.0%	0.0%	10%
		2		3	3	2	10
		20%		30%	30%	20%	100%

Table 38: Where bamboo should be planted outside the park

IV. DISCUSSION OF FINDINGS

IV.1 Bamboo production potential in community woodlots around NNP

This study showed that there is a high bamboo production potential around NNP. This is justified by the fact all of the respondents in the assessment showed that they use bamboo in one way or another and some of them have already few bamboo on their plots. The usage of bamboo mentioned includes handcraft making, construction, bean poles and some of them sell bamboo on the market. Also most of interviewed bamboo growers (64.7%) reported that bamboo has a high development potential compared to other crops in the area. Farmers mostly use bamboo products as materials for harvesting and transportation of commodities. They suggested that to increase bamboo availability in the area, the government and/or donors should provide seedlings trainings on bamboo propagation and processing, and provide financial support. Also it was found that most of bamboo collected is used y households (81.3% of respondents confirmed this).

Despite is small development, once extended bamboo can be used in different ways by Rwandans and this would create rural jobs. Houses in Rwanda are constructed using imported materials while we can get high quality products from bamboo for ceilings, floors, doors, windows, frames, furniture, fences, etc. Bamboo houses (or those incorporating bamboo as a structural material) are quite long-lasting when the bamboo is duly treated ((Rwanda bamboo policy, 2011).



Figure 3: Example of a house with bamboo roof around NNP



Figure 4: Example of an overhang constructed with bamboo

IV.2.Sustainable economic development potential of bamboo

We believe that the capacity of people to sustainably produce, process and market their products contributes highly to their long-term economic development. This assessment looked to all of this in order to find out whether bamboo once developed at large can contribute to sustainable development in this area. Although people around NNP use mainly bamboo for household needs, some of bamboo collected is sold on local markets. This brings cash income to households. Bamboo is also known for its strong rooted system that may combat soil erosion. Bamboo may serve as carbon sink, therefore helping to mitigate climate change. Bamboo is often associated with threatened plants, and there are many specialized animal species that depend upon them (National Bamboo Policy, 2011). This study also assessed the capacity of local people to produce, to process and to market bamboo. It was found that different partners supported local people financially and technically to produce and process bamboo during few last years.

Despite its large usage in the area, most of bamboo was reported to be harvested in NNP and Kibira Forest Reserve in Burundi. This shows that there is a need to develop bamboo in the region so that people can get it without much risks of being caught by forest rangers.

This report shows that the level of knowledge on bamboo development is significantly low. Only 8.8% of respondents from bamboo growers reported that they were trained in

bamboo nursery development and only 8.1% of respondents from bamboo processors said that they received training on bamboo processing. Also few respondents said that they had partners in bamboo development (37.5%). Partners mentioned by the respondents are HELPAGE, Protected Areas Biodiversity (PAB), WCS and Rwanda Development Board (RDB). It was mentioned that these partners were involved in bamboo planting and trainings but that their programs were not successful as it was indicated by 81.3% of respondents. Observation in field shows that there is very few dispersed bamboo on plots of local people and the dominant species is *Bambusa vulgaris* which is not preferred by farmers because of its low growth.

Supporting local community in propagation of bamboo species preferred by local people, empowering them to process bamboo that they harvest and to market the bamboo products that they process can help them to extend bamboo and therefore, improve their livelihoods.

Also local people showed much interest in bamboo development as it was shown by 95.5% of tea growers. This people use baskets made in bamboo to collect tea. They said that they need support to establish bamboo nurseries, offsets to directly planting and any other support that can be availed to develop bamboo in the area.

IV.3 Bamboo value chain around NNP

Although most of respondents (41.1%) reported they harvest bamboo in their woodlots, it is obvious that most of bamboo used and/or sold in the area is collected from from NNP and Kibira Forest Reserve in Burundi basing on the observation on ground and since NNP is protected people cannot easily say that they collect bamboo there. Bamboo processors insisted that when bamboo is not sufficient they get it from Burundi where the protection of Kibira forest is not reinforced compared to NNP.

There are three species of bamboo known to grow naturally in Rwanda. These are Yushania (Arundinaria alpine), Bambusa vulgaris, Oxythenanthera abyssinica and Bambusa oreobambos (Bazivamo, 2007). There are people and a cooperative who plant bamboo and who worked with partners in bamboo growing in past years. These people and members of the cooperative said that they buy planting material (offsets) from the market or from dealers, get them independently or get it from other sources that they did not wish to specify, (what must be from the forest). Both bamboo growers and processors said that they prefer Arundinalia alpina (the green bamboo found inside the park) than Bambusa Vulgaris (the yellow bamboo). Growers prefer it because of its rapid growth while processors appreciate its long internodes that make easy processing activities. Arundinalia alpina also mainly grows in the high altitude in the Northern and Western parts of Rwanda such as Gishwati Forest Reserve and Volcano National Park. The growth is facilitated by favorable temperature conditions, high humidity, fertile soil (Bazivamo, 2007). Anastase, one of bamboo growers in COAIRUNYA cooperative said that Bambusa Vulgaris should not be used in the future for bamboo propagation. While comparing two species, he requested

that *Alundinaria alpina* should be used in all zones around NNP. Anastase said: "PAB brought these yellow bamboos (Bambusa Vulgaris) to be directly planted in farmers' field. I planted them but they are now at this stage from 2009. If I get green ones I could replace them".



Figure 5: Anastase showing well growing *Alundinaria*



Figure 6: Anastase showing *Bambusa* that does not grow properly

Bamboo was reported to be sold to local households, bamboo processors, and handcrafts makers and on local markets. None of respondents said that bamboo or bamboo products are sold in Burundi. Normally, cross boarders markets exist for other products. As it is mentioned above Burundi is an important source of bamboo sold and processed in Rwanda side. Respondents said that as in Kibira bamboo highly reduced, Burundian started to cut bamboo in NNP and sell it in Rwanda. They also mentioned that the market for bamboo is higher in Rwanda than in Burundi, the reason why bamboo collected is brought in Rwanda.

Local people also believe that the market for bamboo and its products is growing as it was indicated by 70% of respondents. 86.7% of tea growers confirmed that they use baskets to collect tea and 86.4% of these respondents said that they buy these baskets on the local markets and that they prefer bamboo products because they are durable compared to others.

The main local markets where bamboo and its products are sold are Gatunda, Gisanze and Kabere. Respondents also mentioned that they sell some bamboo raw material and half processed products in Nyanza market in Southern province. They claimed for trainings to empower them to produce the final products that can be sold at higher price. Buyers of bamboo products on local markets are mainly local households (93.3%) and visitors. Processors have no links such as hotels, shops where they sell their products. Although bamboo for processing is not easily available, the price of bamboo products is still low due to the low level of processing technologies and purchasing power of clients. We talked to a woman who was bring he baskets to Gatunda market, she told as the following: "These baskets are not expensive, one of them can cost no more that 500 Rfw. Bamboo for processing is very hard to get and it is not even allowed to cut bamboo not only inside the Park but also elsewhere, it is planted. The market is Gatunda; where I am going to and different bamboo products can easily be found. Bamboo products market is closed early in the morning. If not we arrested by local authorities".



Figure 7: The woman carrying baskets made in bamboo

As we said above some of the products are sold in Nyanza. We also talked to a guy who buys products from local processors and sell them on Nyanza market. He said: "These products need further processing steps. After these steps the price of my products will be increased but the buyer is the only one who will benefit from that processing. They sell a basket for 2000 to 3000 Rwf. This is a very high price because here the price can not go beyond 1500 Rwf".



Figure 8: Baskets made in bamboo sold on Nyanza market

Even if bamboo is only traditionally processed in the area, bamboo products demand is still high versus the supply as it was confirmed by 95.5% of respondents. One of the reasons must be the fact that harvesting bamboo in the park is not allowed and that no programs are in place to develop bamboo outside the park. This shows that there is a high bamboo development potential in areas surrounding NNP. However, any program that can intervene in this field should consider modern bamboo processing and extend the bamboo market because the subsistence consumption cannot help these people to develop for long-term. Products such as local baskets, mats and local construction materials are not sold on big markets.

This study shows that there is much needed to support local people to develop bamboo around NNP. Bamboo growers said that they are challenged by low bamboo price and lack of offsets and better techniques to multiply and grow bamboo. Processors find that bamboo products prices are very low, they lack capacity to produce many products in short time, no access to markets and lack of modern techniques in bamboo processing. Indeed, It is recognized that bamboo processing can be easier to support than wood processing. Bamboo processing, in comparison to wood, is delightfully simple; it splits linearly, naturally, even with a simple knife or harvesting sickle. In comparison, most value added products from wood need machines and tools, which require purchasing power and much capital investments (BAZIVAMO, 2007).

IV.4 Whether and where an investment in bamboo cultivation will contribute significantly to the reduction in illegal bamboo harvesting in NNP

It is a good sign that most of local leaders (81.3% of respondents) know that bamboo cutting within NNP is a threat to wildlife and that there are already some effective measures in place to reduce this illegal activity. The measures include paying fines, imprisonment and confiscation.

Also local leaders suggested extending bamboo outside the park so that local people can get it as an alternative of what they illegally collect in the park. They suggested that bamboo should be planted along rivers, along roads and some of them pointed the possibility of planting bamboo in the junction of two agricultural plots or on their own plots where there is public land or where farmers wish to plant them on a given plot.

V. CONCLUSION AND RECOMMENDATIONS

V.1 Conclusion

The results of this assessment show that bamboo has a high development potential around NNP. Local use this resource in different ways for subsistence and for income generation. Local leaders supported and are willing to support bamboo development programs. They also contribute a lot in law enforcement to reduce illegal bamboo harvesting within the park and they suggest that developing bamboo outside the park as an alternative can considerably reduce illegal bamboo harvesting within the park.

Also local people including bamboo users, growers, processors and sellers showed much interest in bamboo growing. However they need assistance to increase bamboo, its products, generate income from bamboo business and therefore improve their livelihoods and reduce their pressure on the park. They need bamboo seedlings, trainings in bamboo propagation, processing and marketing.

V.2 Recommendations

We recommend the following for sustainable development of bamboo around NNP

- Assist local farmers to access bamboo seedlings
- Train local bamboo growers in bamboo propagation techniques
- Empower local bamboo processors to improve the quality of products and increase the quantity
- Support bamboo processors and bamboo products sellers in bamboo marketing and business development in order to increase income from bamboo business.
- in order to exchange information and experience so that bamboo availability is increased.
- Support local people who may be involved in bamboo development to be grouped in cooperatives in order to combine their forces to increase production
- Encourage involvement of women
- Collaborate with the management of Kibira Forest to reduce illegal bamboo harvesting
- Link bamboo development with other forestry activities in the area
- Focus on local bamboo, *Arundinaria alpina* while developing bamboo i the areas around NNP
- Conduct more research on *Bambusa vulgaris* and other species that can possibly be adopted in the region
- Direct planting using bamboo offsets is recommended when bamboo multiplication in nurseries is not yet started.
- Identification of location and sites where bamboo development programs especially bamboo multiplication should be done is necessary.

- Planting bamboos on waterways has been generally successful in volcanoes but those planted inside waterways have been carried away by water currents from the park so further planting should be only done on their banks.
- It is vital to establish periodical assessment on bamboo current situation around NNP.

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ANNEXES

Annex 1: Important use of bamboo

Important Use of Bamboo	Sector Name			
	BUSANZE	NYABIMATA	RUHERU	Total
Construction	0	0	1	1
	0.0%	0.0%	0.4%	0.4%
Hand& Construction	4	1	22	27
	1.6%	0.4%	8.6%	10.5%
Construction& Handcraft	2	1	6	9
	0.8%	0.4%	2.3%	3.5%
Hand,Constr&Bean poles	0	0	4	4
	0.0%	0.0%	1.6%	1.6%
Hand,Constr&Sale at market	4	0	27	31
	1.6%	0.0%	10.5%	12.1%
Hand,Constr& Other	0	0	2	2
	0.0%	0.0%	0.8%	0.8%
Constr,Hand&Bean poles	5	0	17	22
	2.0%	0.0%	6.6%	8.6%
Constr,Hand&Food Cooking	0	0	1	1
	0.0%	0.0%	0.4%	0.4%
Constr,Hand&sale at market	2	0	12	14
	0.8%	0.0%	4.7%	5.5%
Sale at market,Hand.&Constr.	0	0	2	2
	0.0%	0.0%	0.8%	0.8%
Sale at market,Constr.&Hand.	0	0	1	1
	0.0%	0.0%	0.4%	0.4%

Hand,Constr.,Bean&Food cooking	1	0	0	1
	0.4%	0.0%	0.0%	0.4%
Hand,Constr.,Bean&sale at market	0	0	4	4
	0.0%	0.0%	1.6%	1.6%
Hand.,Constr.,sale&Bean Poles	1	0	4	5
	0.4%	0.0%	1.6%	2.0%
Hand.,Constr.,sale&Food cooking	0	0	1	1
	0.0%	0.0%	0.4%	0.4%
Constr.,Hand,Bean&Food cooking	0	0	3	3
	0.0%	0.0%	1.2%	1.2%
Constr.,Hand,Bean&Sale at market	4	0	10	14
	1.6%	0.0%	3.9%	5.5%
Constr.,Hand,Food&Bean poles	0	0	1	1
	0.0%	0.0%	.4%	0.4%
Constr.,Hand,Sale&Bean poles	1	0	7	8
	0.4%	0.0%	2.7%	3.1%
Constr.,Hand,Sale&Food cooking	1	0	0	1
	0.4%	0.0%	0.0%	0.4%
Constr.,bean,food&Sale at market	0	0	1	1
	0.0%	0.0%	.4%	0.4%
Hand,Constr,Bean,Food&Sale at	1	0	17	18
market	0.4%	0.0%	6.6%	7.0%
Hand,Constr,Bean,Sale&Food	0	0	1	1
cooking	0.0%	0.0%	.4%	0.4%
Hand,Constr,Food,Bean&Sale at	1	0	3	4
market	0.4%	0.0%	1.2%	1.6%
Hand,Constr,Sale,Bean&Food	1	0	7	8
cooking	0.4%	0.0%	2.7%	3.1%
Hand,Sale,Constr,Food&Bean poles	0	0	1	1

	0.0%	0.0%	0.4%	0.4%
Constr,Hand,Bean,Food&Sale at	5	0	20	25
market	2.0%	0.0%	7.8%	9.8%
Constr,Hand,Bean,Food&Other	0	0	1	1
	0.0%	0.0%	0.4%	0.4%
Constr,Hand,Bean,Sale&Food	5	0	8	13
cooking	2.0%	0.0%	3.1%	5.1%
Constr,Hand,Food,Bean&Sale at	1	0	2	3
market	0.4%	0.0%	0.8%	1.2%
Constr,Hand,Sale,Bean&Food	5	1	15	21
cooking	2.0%	0.4%	5.9%	8.2%
Constr,Hand,Sale,Food&Other	1	0	0	1
	0.4%	0.0%	0.0%	0.4%
Sale,Hand,Constr,Bean&Food	0	0	1	1
cooking	0.0%	0.0%	0.4%	0.4%
Hand,Constr,Food,Bean,Sale&Other	0	0	1	1
	0.0%	0.0%	0.4%	0.4%
Hand,Constr,Sale,Food,Bean&Other	0	0	2	2
	0.0%	0.0%	0.8%	0.8%
Constr,Hand,Bean,Food,Sale&Other	0	0	1	1
	0.0%	0.0%	0.4%	0.4%
Constr,Hand,Bean,Sale,Food,&Other	0	0	1	1
	0.0%	0.0%	0.4%	0.4%
Missing	0	0	1	1
	0.0%	0.0%	0.4%	0.4%
	45	3	208	256
	17.6%	1.2%	81.3%	100%

Annex 2: Proportion of bamboo used for local consuption

	Subsist	tence			
		Sector Name			
	RANGE	BUSANZE	NYABIMATA	RUHERU	Total
Subsistence	10-14(%)	0	0	1	1
		0.0%	0.0%	0.4%	0.4%
	15-19(%)	0	0	1	1
		0%	0%	0.4%	0.4%
	20-24(%)	1	0	3	4
		0.4%	0.0%	1.2%	1.6%
	25-29(%)	0	0	2	2
		0%	0%	0.8%	0.8%
	30-34(%)	1	0	14	15
	(1.5)	0.4%	0.0%	5.5%	5.9%
	35-39(%)	0	0	3	3
		0.0%	0.0%	1.2%	1.2%
	40-44(%)	4	0	24	28
		1.6%	0.0%	9.4%	10.9%
	45-49(%)	0	0	2	2
		0.0%	0.0%	0.8%	0.8%
	50-54(%)	2	0	9	11
		0.8%	0.0%	3.5%	4.3%
	55-59(%)	0	0	2	2
		0.0%	0.0%	0.8%	0.8%
	60-64(%)	4	0	31	35
		1.6%	0.0%	12.1%	13.7%
	65-69(%)	0	0	4	4
		0.0%	0.0%	1.6%	1.6%
	70-74(%)	6	0	25	31

		2.3%	0.0%	9.8%	12.1%
75-79(%)	75-79(%)	7	0	20	27
		2.7%	0.0%	7.8%	10.5%
	80-84(%)	13	0	41	54
		5.1%	0.0%	16.0%	21.1%
	85-89(%)	1	1	14	16
		0.4%	0.4%	5.5%	6.3%
	>90(%)	6	2	12	20
		2.3%	0.8%	04.7%	7.8%
Total		45	3	208	256
		17.6%	1.2%	81.3%	100%

Annex 3: Proportion of bamboo used for commercial purposes

	Commercia	ıl purpose			
		Sector Name			
		BUSANZE	NYABIMATA	RUHERU	Total
Commercial	0-4(%)	1	0	0	1
		0.4%	0.0%	0.0%	0.4%
	5-9(%)	0	1	1	2
		0.0%	0.4%	0.4%	0.8%
	10-14(%)	5	2	14	21
		2.0%	0.8%	5.5%	8.2%
	15-19(%)	1	0	15	16
		0.4%	0.0%	5.9%	6.3%
	20-24(%)	15	0	41	56
		5.9%	0.0%	16.0%	21.9%
	25-29(%)	5	0	19	24
		2.0%	0.0%	7.4%	9.4%

	30-34(%)	6	0	23	29
		2.3%	0.0%	9.0%	11.3%
	35-39(%)	0	0	4	4
		0.0%	0.0%	1.6%	1.6%
	40-44(%)	4	0	31	35
		1.6%	0.0%	12.1%	13.7%
	45-49(%)	0	0	1	1
		0.0%	0.0%	0.4%	0.4%
	50-54(%)	1	0	10	11
		0.4%	0.0%	3.9%	4.3%
	55-59(%)	0	0	2	2
		0.0%	0.0%	0.8%	0.8%
	60-64(%)	4	0	25	29
		1.6%	0.0%	9.8%	11.3%
	65-69(%)	0	0	3	3
		0.0%	0.0%	1.2%	1.2%
	70-74(%)	2	0	12	14
		0.8%	0.0%	4.7%	5.5%
	75-79(%)	0	0	2	2
		0.0%	0.0%	0.8%	0.8%
	80-84(%)	1	0	4	5
	33 3 1(73)	0.4%	0.0%	1.6%	2%
	85-89(%)	0	0	1	1
		0.0%	0.0%	0.4%	0.4%
Total	1	45	3	208	256
		17.6%	1.2%	81.3%	100%

Annex 4:.Dynamics of bamboo demand in the study area

			Cell Name							
Sector Name			KAbere	Kirarangombe	Nkanda	Remera	Runyombyi	Ruyenzi	Uwumusebeya	Total
BU	Status of	Decreasin		0	1		1			2
SA NZ E	the market for bamboo	g		0.0%	16.7%		16.7%			33.3%
		Growing		2	1		1			4
		_		33.3%	16.7%		16.7%			66.7%
	Total			2	2		2			6
				33.3%	33.3%		33.3%			100%
RU	Status of	Decreasin	0			0		1	0	1
HE RU	the market for bamboo	g	0.0%			0.0%		10.0%	0.0%	10%
		Growing	2			2		1	2	7
			20.0%			20.0%		10.0%	20.0%	70.0%
		Staying the same	0			1		1	0	2
			0.0%			10.0%		10.0%	0.0%	20%
	Total		2			3		3	2	10
			20.0%			30.0%		30.0%	20.0%	100%

Annex 5: support of respondents in bamboo development

	Cell				
	Mishungero	Ruyenzi	Uwumusebeya	Total	
Land for Bamboo development	1	1	0	2	
	2.3%	2.3%	0.0%	4.5%	
Land for planting	0	2 1		3	
	0.0%	4.5%	2.3%	6.8%	
Work-force (Bamboo and planting)	0	14	6		
	0.0%	31.8%	13.6%	45.5%	
Follow up of Bamboo	0	5	0	5	
	0.0%	11.4%	0.0%	11.4%	
Others	0	1	0	1	
	0.0%	2.3%	0.0%	2.3%	
Land for Bamboo Dvp& land for	0	1	0	1	
Planting	0.0%	2.3%	0.0%	2.3%	
Land for Planting& Work Force	0	2	0	2	
	0.0%	4.5%	.0%	4.5%	
Work Force& Follow up of Bamboo	2	5	2	9	
	4.5%	11.4%	4.5%	20.5%	
Work Force& Other	0	0	1	1	
	0.0%	0.0%	2.3%	2.3%	
Total	3	31	10	44	
	6.8%	70.5%	22.7%	100%	

Annex 6: Greatest challenges in bamboo processing

	What are you	ır greatest challenges in ba						
	Raw material	Low capacity of production	Market	Missing	Raw materials and Low capacity	Raw material and markets	Low capacity and Market	Total
KABERE	10	1	5	0	1	12	1	30
	27.0%	2.7%	13.5%	0.0%	2.7%	32.4%	2.7%	81.1%
Ruyenzi	2	0	2	1	0	1	0	6
	5.4%	0.0%	5.4%	2.7%	0.0%	2.7%	0%	16.2%
Uwumusebeya	0	0	0	1	0	0	0	1
	0.0%	0.0%	.0%	2.7%	0.0%	0.0%	0%	2.7%
Total	12	1	7	2	1	13	1	37
	32.4%	2.7%	18.9%	5.4%	2.7%	35.1%	2.7%	100%